WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

a semiconductor substrate of a first conductivity type;

a first region of a second conductivity type formed on and in direct contact with said semiconductor substrate;

5    a second region of the second conductivity type formed at and near the surface of said first region;

a third region of the first conductivity type formed at and near the surface of said first region, and surrounding said second region;

a first electrode portion formed on the surface of said third region

10   located between said first and second regions with an insulating film therebetween;

a second electrode portion connected to said second region;

a third electrode portion connected to said first region and spaced by a distance from said third region; and

15   a fourth region of the first conductivity type formed at and near the surface of said first region between said third electrode portion and said third region;

said fourth region having a depth changing as a position moves in a direction crossing a direction of flow of the current.

2. The semiconductor device according to claim 1, further comprising:

a fifth region of the first conductivity type surrounding said third electrode portion, and formed at and near the surface of said first region.

3. The semiconductor device according to claim 1, wherein said fourth region is fixed to a constant potential.

4. The semiconductor device according to claim 3, wherein said fourth region is electrically connected to said first electrode portion or said second electrode portion.

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5. The semiconductor device according to claim 1, wherein said fourth regions are formed discretely, and

the neighboring fourth regions are spaced from each other by a distance allowing connection between depletion layers extending from the neighboring fourth regions, respectively, in an on state.

6. The semiconductor device according to claim 5, wherein assuming that said first region has an impurity concentration of $N_A$, said fourth region has an impurity concentration of $N_D$, the neighboring fourth regions are spaced by a distance of W, a required breakdown voltage is V, an amount of charges is q, a dielectric constant of the vacuum is $\varepsilon$, a relative dielectric constant of silicon is $\varepsilon'$, and the impurity concentration $N_A$ is sufficiently larger than the impurity concentration $N_D$, and is substantially infinite, the following formulas are satisfied:

$$V > qN_DW^2/(8\varepsilon\varepsilon')$$
$$W < 2(2V\varepsilon\varepsilon'/(qN_D))^{(1/2)}$$

7. A semiconductor device comprising:

a semiconductor substrate of a first conductivity type;

a first region of a second conductivity type formed on and in direct contact with said semiconductor substrate;

a second region of the second conductivity type formed at and near the surface of said first region;

a third region of said first conductivity type formed at and near the surface of said first region, and surrounding said second region;

a first electrode portion connected to said third region;

a second electrode portion connected to said second region;

a third electrode portion spaced from said third region by a distance, and connected to said first region; and

a fourth region of the first conductivity type formed at and near the surface of said first region between said third electrode portion and said third region;

said fourth region having a depth changing as a position moves in a

direction crossing a direction of flow of the current.

8. The semiconductor device according to claim 7, wherein said fourth region is fixed to a constant potential.

9. The semiconductor device according to claim 8, wherein said fourth region is electrically connected to said first electrode portion or said second electrode portion.

10. The semiconductor device according to claim 7, wherein said fourth regions are formed discretely, and
the neighboring fourth regions are spaced from each other by a distance allowing connection between depletion layers extending from the neighboring fourth regions, respectively, in an on state.

11. The semiconductor device according to claim 10, wherein assuming that said first region has an impurity concentration of $N_A$, said fourth region has an impurity concentration of $N_D$, the neighboring fourth regions are spaced by a distance of W, a required breakdown voltage is V, an amount of charges is q, a dielectric constant of the vacuum is $\varepsilon$, a relative dielectric constant of silicon is $\varepsilon'$, and the impurity concentration $N_A$ is sufficiently larger than the impurity concentration $N_D$, and is substantially infinite, the following formulas are satisfied:

$$V > qN_DW^2/(8\varepsilon\varepsilon')$$
$$W < 2(2V\varepsilon\varepsilon'/(qN_D))^{(1/2)}$$